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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61C 5/10, 13/00, A61K 6/06 — A1

(11) International Publication Number: WO 95/35070

(43) International Publication Date: 28 December 1995 (28.12.95)

(21) International Application Number: PCT/DK95/00197

(22) International Filing Date: 18 May 1995 (18.05.95)

(30) Priority Data:
0721/94 20 June 1994 (20.06.94) DK

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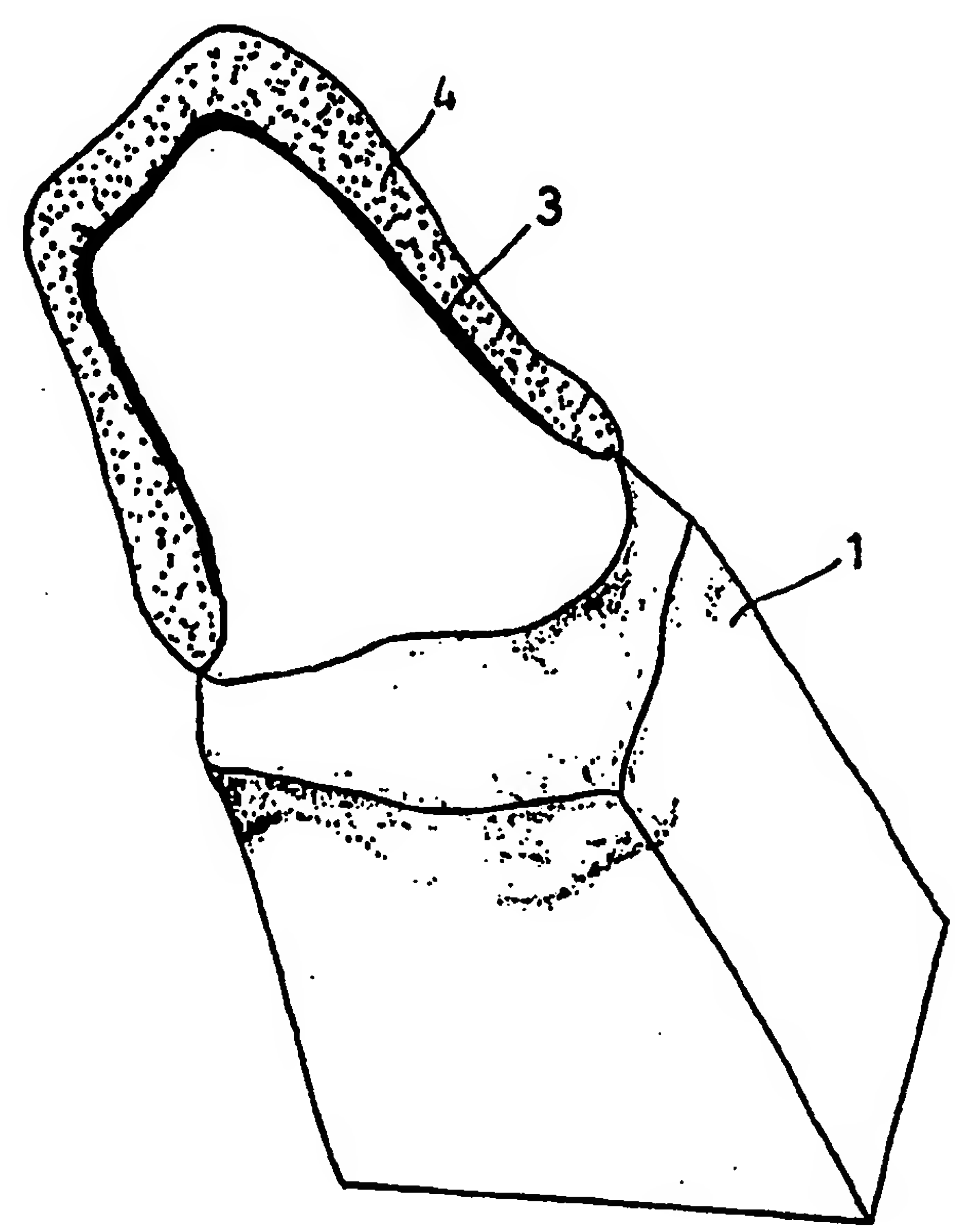
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
In English translation (filed in Danish).

(54) Title: PROCEDURE FOR THE PRODUCTION OF CERAMIC TOOTH RESTORATIONS AND MATERIALS FOR DISTANCE, SEPARATION AND SUBSTRUCTURE FOR THE CARRYING OUT OF THE PROCEDURE

(57) Abstract

In the procedure a substructure (4) is produced by modelling directly on a master model (1) to which has been applied a layer of distance material (2) and a layer of separation material (3). After drying of the master model (1) with applied substructure material for one minute at 80 °C the substructure material (4) can be removed from the master model (1) as an independent substructure, which is heat treated first by heating to 500 °C for at most 10 minutes, whereby the bonding agent is removed, and thereafter by heating to 1120 °C for 2 hours, whereby the material is sintered. After cooling the substructure (4) is checked on the master model (1), whereafter a layer of glass is applied and thereafter heated to 1100 °C for 2-4 hours whereby an infiltration of glass in the substructure material takes place. After removal of the excess glass a ceramic can be applied in the known manner. The separation material (2) consists of a mixture of completely combustible plasticine and chloroform in a mixing ratio enabling the material to be applied with a brush at 22 °C, but to harden at approx. 20 °C. The substructure material (4) consists of demineralised water, cellulose powder, sugar and oxide ceramic.



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Procedure for the production of ceramic tooth restorations and materials for distance,separation and substructure for the carrying out of the procedure.

The present invention relates to a procedure for the manufacture of ceramic tooth restorations using a master model of plaster, and which comprises a substructure of aluminium oxide and an infiltration material of glass and several layers of glass ceramic.

In the known procedure the first step is the production of a master model of plaster on the basis of an impression. This master model is given distance varnish, and a duplicating mould of a silicone material is produced. When the stresses in the duplicating mould have been relieved it is cast in special plaster. After the special plaster has set, the special plaster model is removed from the mould. Next a substructure material which contains oxide ceramic is stirred.

This material is applied with a brush to the special plaster model, which is thereafter heated to 1120°C for ten hours.

When cooled the substructure is removed from the special plaster, and the fit of the substructure is checked on the master model. Hereafter a glass material is applied to the substructure, which is then baked in a special chamber at 1100°C for 4½ hours.

When cooled the excess glass is removed, and an extra layer of glass ceramic is applied.

This known procedure is cumbersome and time consuming and therefore expensive in use. Furthermore, it is not possible to perform casting on metal, wherefore the procedure cannot be used for tooth restorations on the basis of implants.

It is a purpose of the present invention to describe a procedure for the production of ceramic tooth restorations, which does not involve the drawbacks of the known procedures.

This can be achieved by the procedure described in claim 1.

Claim 2 relates to a preferred drying temperature and drying time for the master model which has been supplied with substructure material.

Claim 3 relates to a preferred heat treatment of the substructure.

Claim 4 relates to control of the substructure and the subsequent application of glass.

The invention also relates to a separation material and a substructure material to be used in the carrying out of the procedure according to the invention.

Claim 5 relates to a preferred composition of a separation material according to the invention.

Claim 6 relates to a preferred mixing ratio of the components in a separation material according to the invention.

Claim 7 relates to a preferred composition of a substructure material according to the invention.

Claim 8 relates to a preferred method of production and the mix proportion of the components in a substructure material according to the invention.

Claim 9 relates to a first form for oxide ceramic to be used in a substructure material according to invention.

Claim 10 relates to another form of oxide ceramic to be used in a substructure material according to the invention.

Claim 11 relates to a third form of oxide ceramic to be used in a substructure material according to the invention,

claim 12 relates to a fourth form of oxide ceramic to be used in a substructure material according to the invention.

The invention is explained in detail below with reference to the drawing in which

fig. 1 shows a master model onto which is applied a layer of distance material and a layer of separation material,

fig. 2 shows a partial cross-section corresponding to the illustration in fig. 1, which partial section is applied with a substructure material on top of the separation material,

fig. 3 shows the master model with the substructure removed, after drying,

fig. 4 shows the substructure removed from the master model, after drying

fig. 5 shows in a partial cross-section a ceramic tooth filling which is built up on a substructure,

fig. 6 shows auxiliary parts of metal for the production of a suprastructure on implants,

fig. 7 shows the parts shown in fig. 6 joined and in the process of application with separation material, and

fig. 8 is a picture similar to the one in fig. 7 in which a sectional view shows the substructure material after application,

fig. 9 shows a master model with implant dummies,

fig. 10 shows a picture similar to the one in fig. 9, in which attachment elements have been firmly screwed onto the implant dummies, and

fig. 11 shows a picture similar to the one in fig. 10, where the attachment elements have been combined with a substructure.

As shown in fig. 1 the procedure according to the invention is first to apply a layer of distance material 2, which may consist of wax, onto the master model 1, and then a layer of separation material 3, which to advantage can consist of fully combustible plasticine and chloroform in such a mixing ratio as to be applicable with a brush at 22°C, but which hardens at 20°C. These properties are obtainable with a mixing ratio of 6 g of plasticine to 30 ml chloroform.

As shown in fig. 2 a modelling substructure material 4 is hereafter applied on top of the separation material 3. According to the invention the substructure material 4 can consist of demineralised water, cellulose powder, sugar and an oxide ceramic, and it can be produced by first making a liquid, with a mixing ratio of 75 ml demineralised water to which is added 0·5 g cellulose derivative and stirring it for approx. one minute, whereafter the mixture is passed through a chemical paper filter and adding 5 g sugar, whereafter 1·32 ml of this liquid is mixed with 10 g of oxide ceramic.

As an oxide ceramic can be used either aluminium oxide, zirconium oxide, magnesium oxide, a mixture of aluminium oxide and zirconium oxide, a mixture of magnesium oxide and zirconium oxide, or a mixture of aluminium oxide and magnesium oxide.

Then the master model with the applied layer of substructure material 4 is dried for approx. one minute at 80°C.

The separation material 3 prevents the substructure material 4 from drying out during the process of application onto the master model. At the same time the separation material 3 diffunds into both the plaster in the master model and into the substructure material 4 during the drying process, so that the substructure material as shown in fig. 3 and 4, after the drying process is easy to remove from the master model as an independent substructure unit without damage to the master model.

Thereafter the substructure 4 is heat treated first at 500°C for 10 minutes, whereby the bonding agent is removed, and thereafter at 1120°C for 2 hours in a special chamber, in which the material is sintered, and then the object is cooled.

After the cooling process the substructure 4 is checked on the master model 1, whereafter the surface of the substructure 4 is given a layer of glass and then heated to 1100°C for 2-4 hours, whereby the glass material is absorbed in the substructure material.

After the cooling process the excess glass is trimmed off, and an extra layer of ceramic 5 is applied in the known manner.

It is possible to produce a tooth restoration according to the invention in 8½ hours, where the known procedures take 18½ hours.

In tooth restorations where one or more of the patients teeth have fallen out it is possible to operate one or more carrying metal pins, so-called implants, into the patient's jaw bone. These metal pins are embodied with a threaded hole and are tapering off at the upper end. These metal pins can accommodate a single male threaded tooth crown or a bridge, which can be of the shape of a beam supported in a simple manner or as a single or double corbelled beam, which must have the required bending strength and consequently be made of metal.

In the procedures known so far for the production of ceramic tooth restorations on implants it has been necessary to give the metal part a ceramic cladding. In implants which involve a bridge, the substructure with the belonging teeth are therefore made of metal onto which a glass ceramic is fired. In implants involving individual crowns have been used either metal or specially manufactures crowns of ceramic, which are not adapted to the individual patient.

In the procedure according to the invention it is possible to build up ceramic on a ceramic substructure, whereby tooth restorations with a ceramic surface can be carried out both as single crowns and as bridges adapted to the individual patient and which have the required bending strength.

Fig. 6 shows an auxiliary tool for the production of an attachment element 16 of ceramic. As shown, the tool consists of two metal rods 6 and 7. The rod 6 is at one end embodied with a threaded section 8, then comes a cylindrical section 9, which ends with a shoulder 10 and following that there is a conical section 11. The rod 7, which corresponds to the metal pin which is operated into a patient's jaw bone, is shown embodied with a conical part 13 with a threaded hole 12 at one end. The conical part 13 ends in a shoulder 14.

When the tool is to be used the rods 6 and 7 are joined as shown

in fig. 7 by screwing the threaded part 8 into the threaded hole 12. Thereafter separation material 3 is applied to the surfaces 9,11 and 13, whereafter - as shown in fig. 8 - substructure material 4 is applied with a desired shape. When dried as described above the substructure material can be removed as an independent unit 16, which is heat treated. Thereafter it is possible as shown in fig. 10 to firmly screw on an attachment element 16 on each implant 15 whereafter, as shown in fig. 11, a substructure 17 is built up consisting of a slurry of substructure material as described above between the individual attachment elements. The whole bridge can then be loosened from the master model and heat treated and coated with glass as described above.

When the crown is to be attached on inoperated metal pin this is done by means of a not shown screw, which at one end has a threaded section, a cylindrical section, a shoulder and a conical section corresponding to the parts 8,9,10 and 11, respectively, on the rod 7.

The shown and described embodiments are only examples. It is possible within the framework of the embodiment to imagine other embodiments and applications, for example special tools for the production of other shapes of bridges.

PATENT CLAIMS

1. Procedure for the production of ceramic tooth restorations by the use of a master model (1) of plaster, and which comprises a substructure of aluminium oxide and an infiltration material of glass and several layers of glass ceramic characterized by the fact that the master model (1) is first given a layer of distance material (2), preferably wax, and thereafter given a layer of separation material (3), to seal the surface of the master model, whereafter a substructure material (4) is applied, which contains oxide ceramic, demineralised water, a coagulant and a bonding agent with a composition so that the mixture after stirring, preferably in an ultra sound bath, can be modelled, whereafter the master model (1) with the applied material is dried, and the substructure (4) is removed from the master model (1), whereafter the substructure (4) is heat treated and thereafter cooled, whereafter it is given a supra structure consisting of a layer of glass, and then heat treated again whereby an infiltration of glass occurs in the substructure material.

2. Procedure according to claim 1 characterized by the fact that the master model (1) with the substructure material (4) applied is dried for one minute at approx. 80°C and thereafter cooled, whereafter the substructure is removed from the master model.

3. Procedure according to claims 1 and 2 characterized by the fact that the heat treatment of the substructure (4) is effected first by heating the substructure to approx. 500°C for at most 10 minutes, whereby the bonding agent is removed, and thereafter by heating the substructure to 1120°C for 2 hours in a special chamber, whereby the material is sintered, and then cooled.

4. Procedure according to claims 1-3 characterized by the fact that the substructure (4) after being cooled is checked on the master model (1) and then given a layer of glass and then heated to 1100°C for 2-4 hours.

5. The separation material to be used in the procedure according to claim 1 characterized by the fact that the separation material (2) consists of fully combustible plasticine

and chloroform with a mixing ratio so that the material is applicable with a brush at about 22°C, but hardens at about 20°C.

6. Separation material according to claim 5, c h a r a c t e r i z e d by the fact that the separation material (2) contains plasticine and chloroform in a mixing ratio of 6 g of plasticine to 30 ml of chloroform.

7. Substructure material for application in the procedure according to claim 1, c h a r a c t e r i z e d by the fact that the substructure material (4) consists of demineralised water, cellulose powder, sugar and oxide ceramic, which after stirring is stored in airtight containment.

8. Substructure material according to claim 7, c h a r a c t e r i z e d by the fact that the substructure material (4) is produced by first making up a liquid, with a mixing ratio of 75 ml of demineralised water to which is added 0·5 g of cellulose derivative and stirred for approx. one minute, where after the mixture is passed through a chemical paper filter and added 5 g of sugar, and that 1·32 ml of this liquid is mixed with 10 g oxide ceramic.

9. Substructure material according to claim 7, c h a r a c t e r i z e d by the fact that aluminium oxide is used as oxide ceramic.

10. Substructure material according to claim 7, c h a r a c t e r i z e d by the fact that zirconium oxide is used as oxide ceramic.

11. Substructure material according to claim 7, c h a r a c t e r i z e d by the fact that magnesium oxide is used as oxide ceramic.

12. Substructure material according to claims 9-11, c h a r a c t e r i z e d by the fact that a mixture of aluminium oxide and zirconium oxide, of magnesium oxide and zirconium oxide, or of aluminium oxide and magnesium oxide.

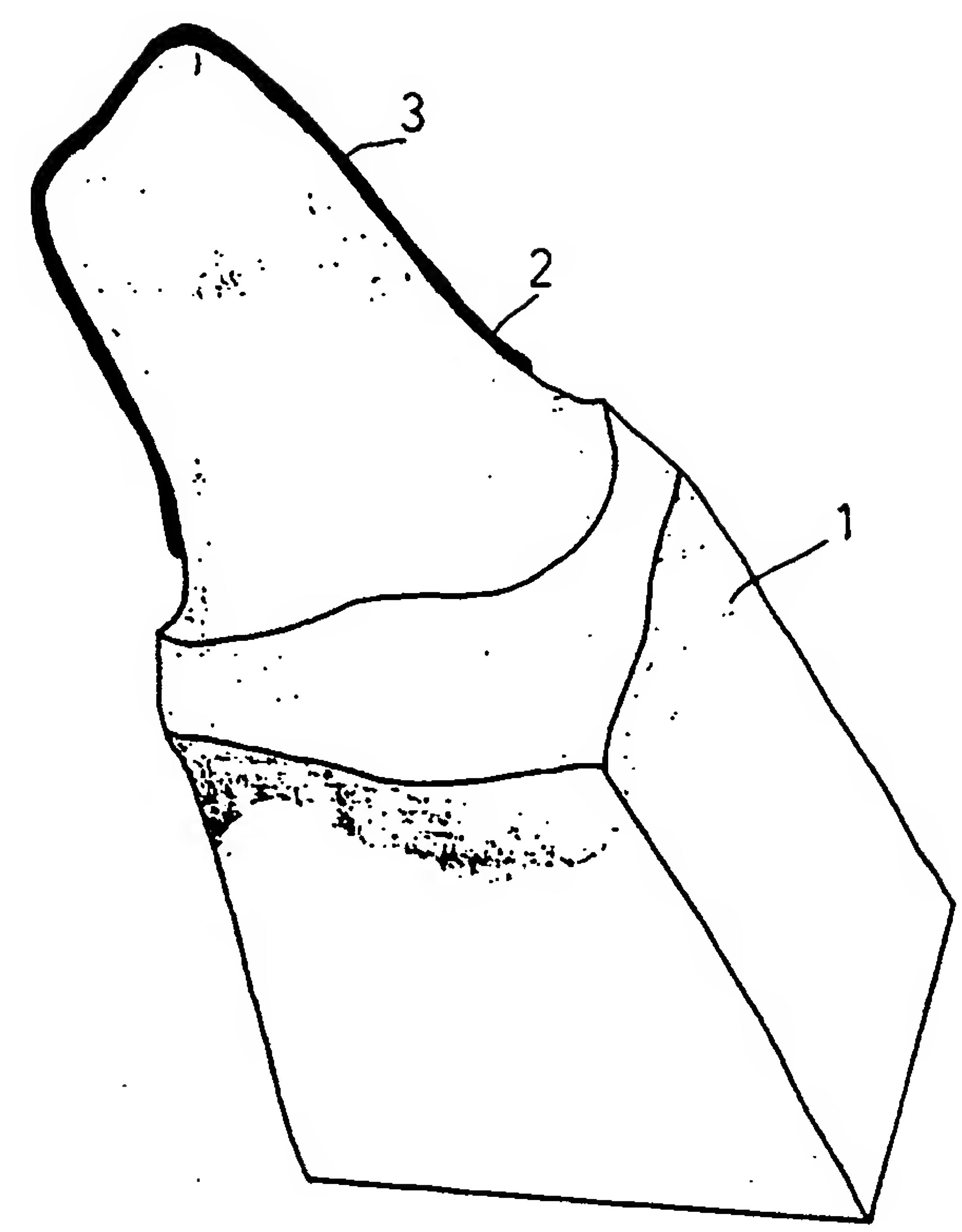

FIG. 1

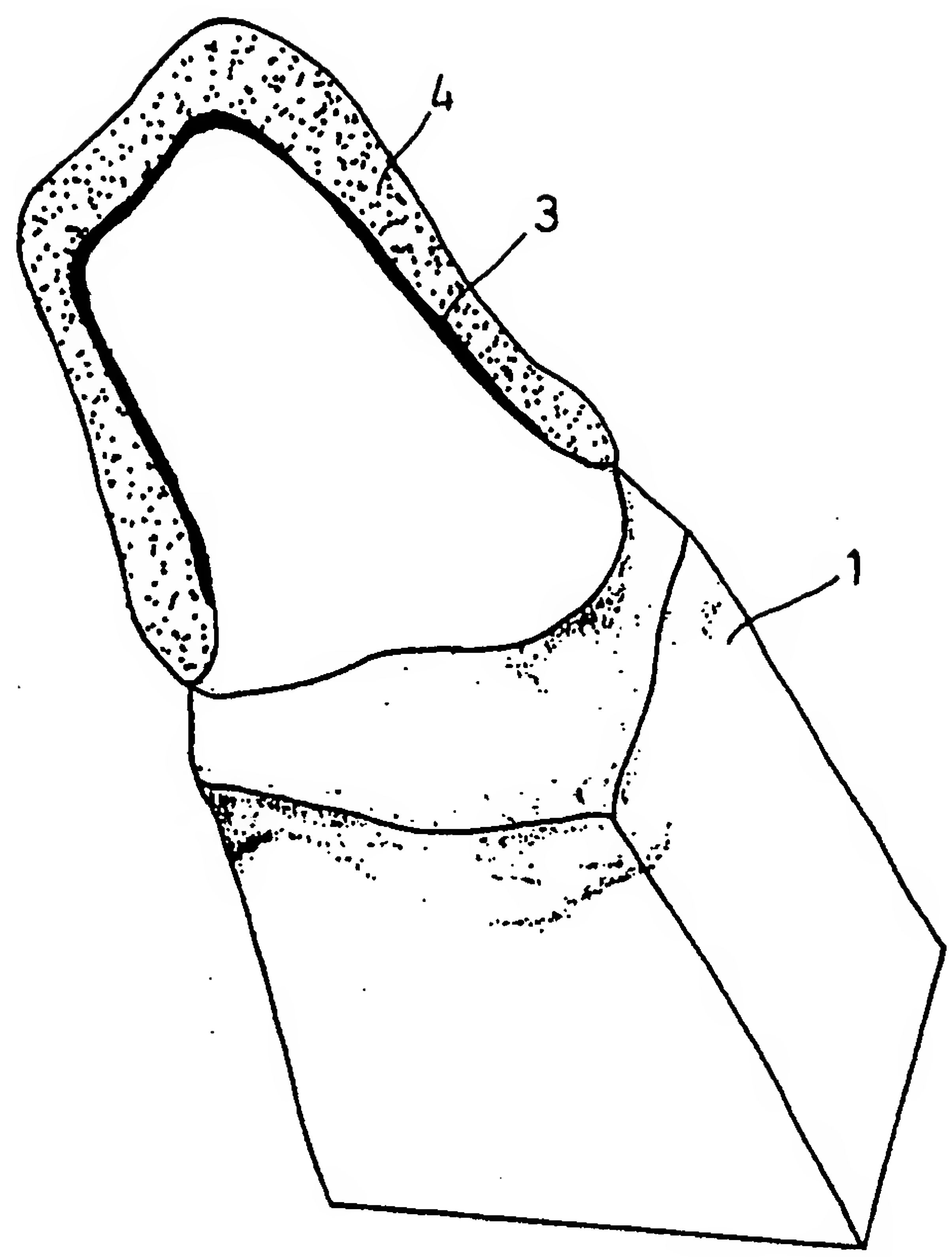

FIG. 2

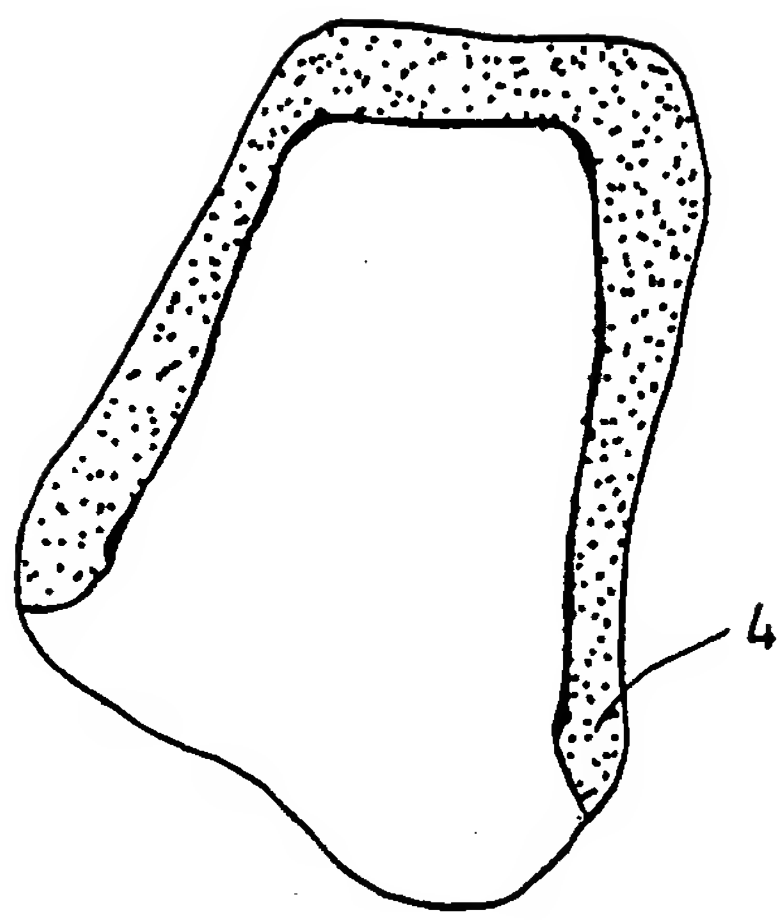

FIG. 4

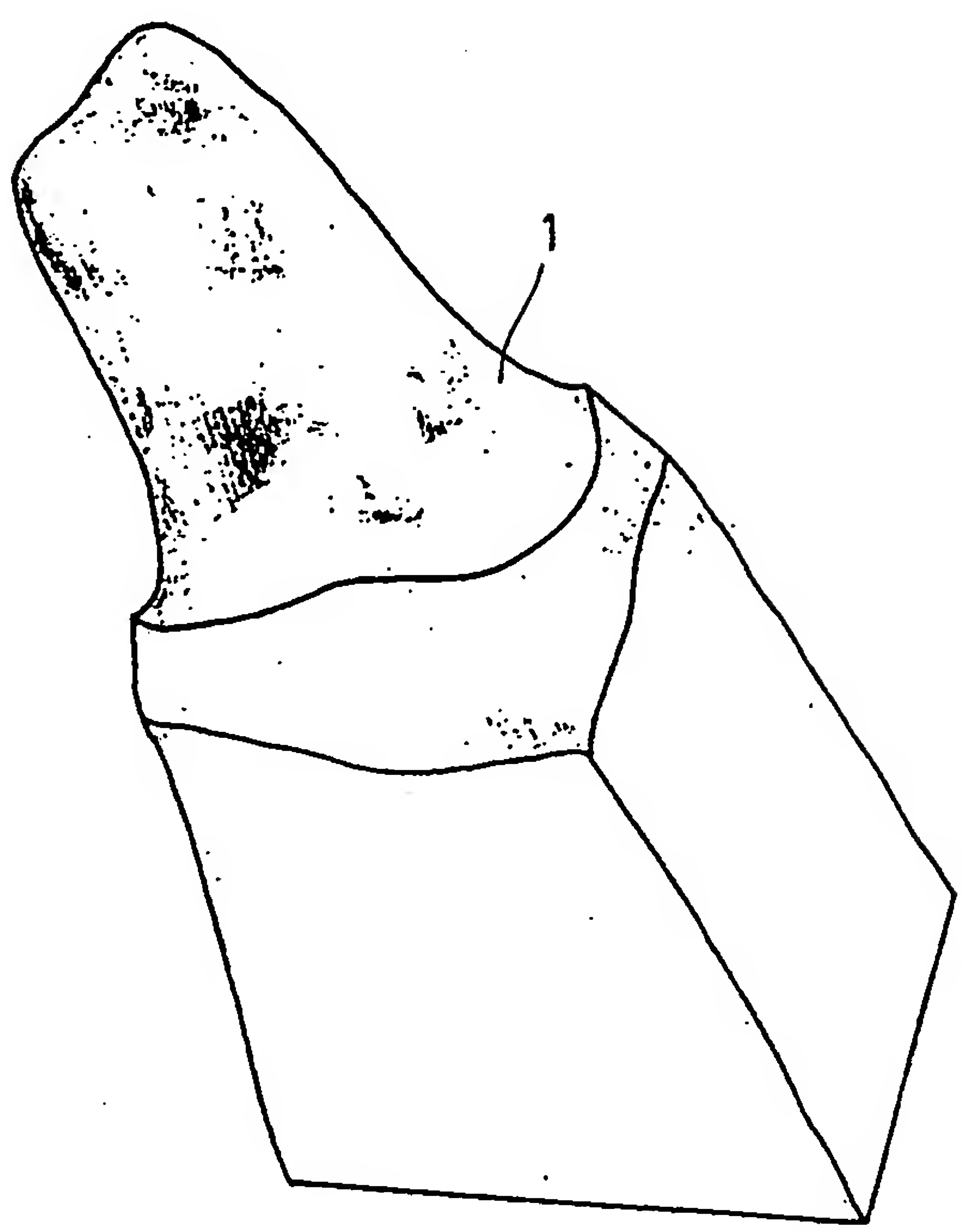

FIG. 3

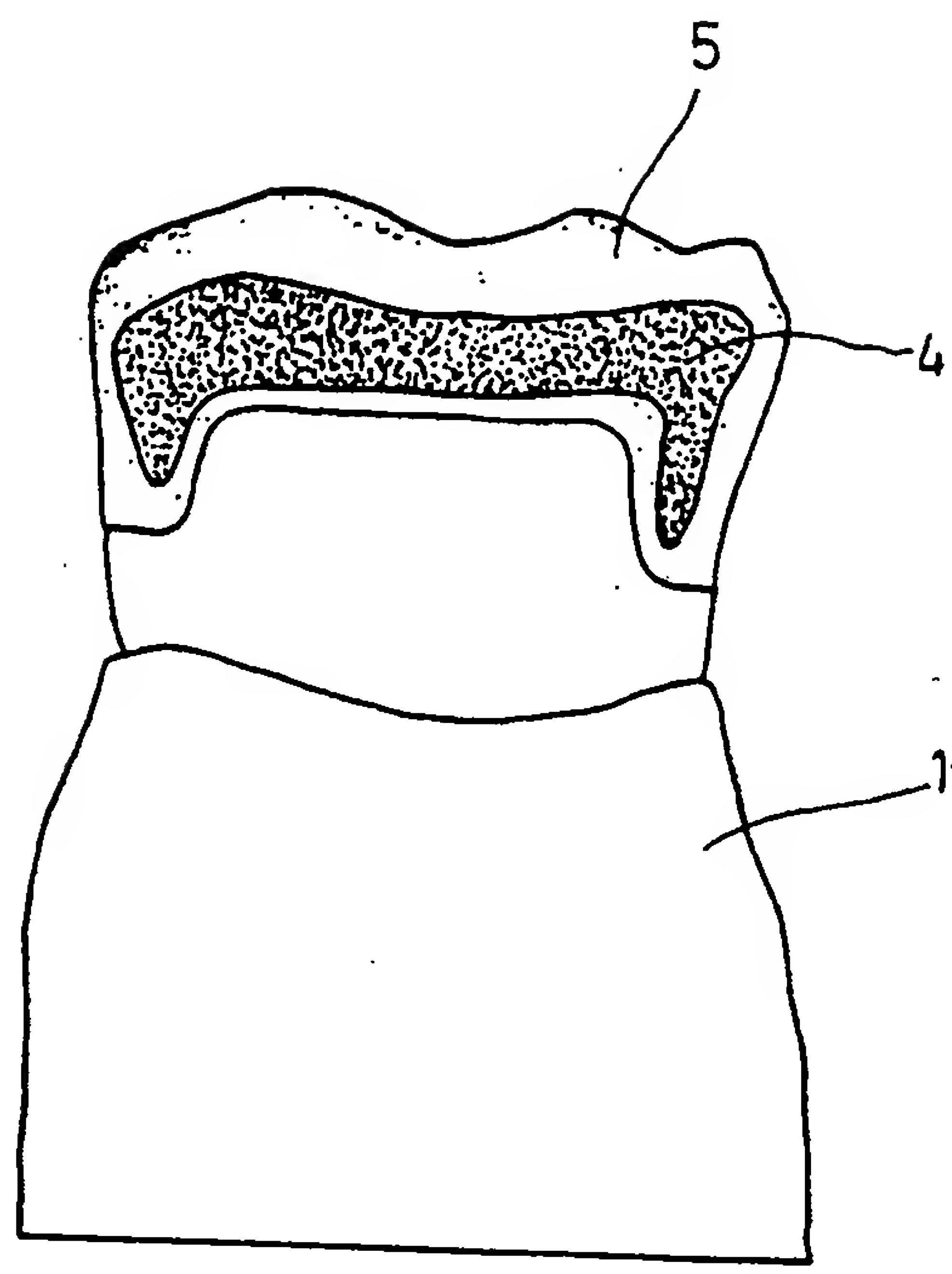

FIG. 5

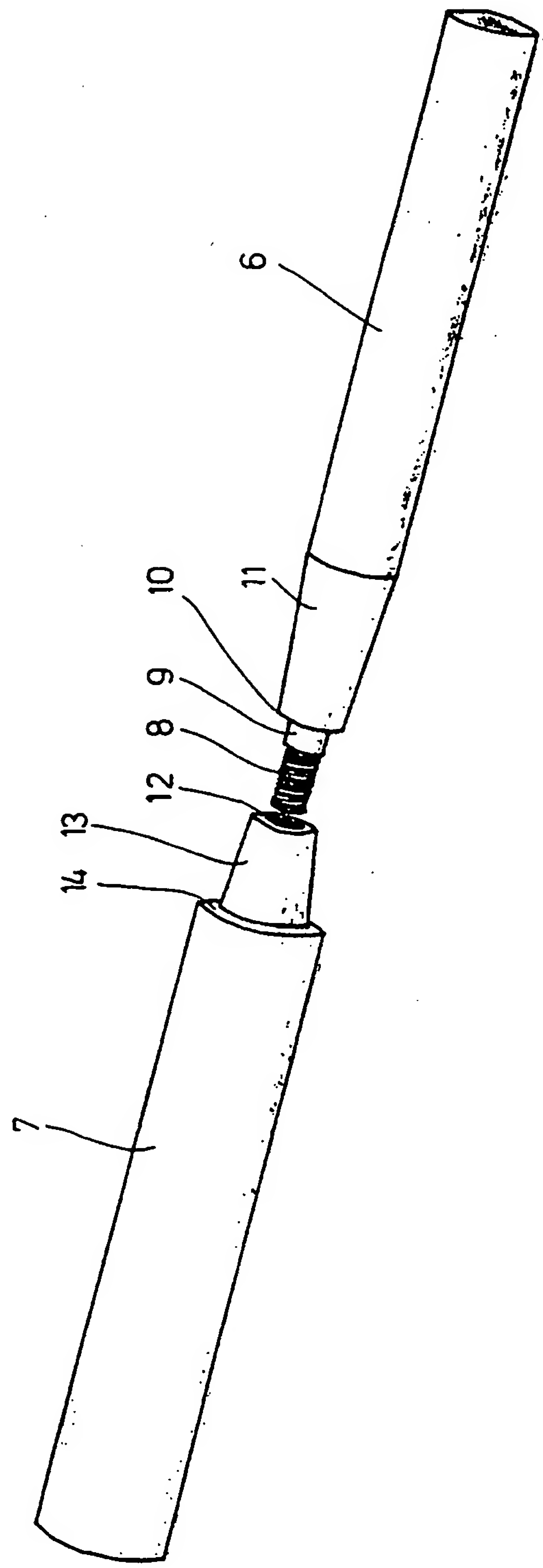

FIG. 6

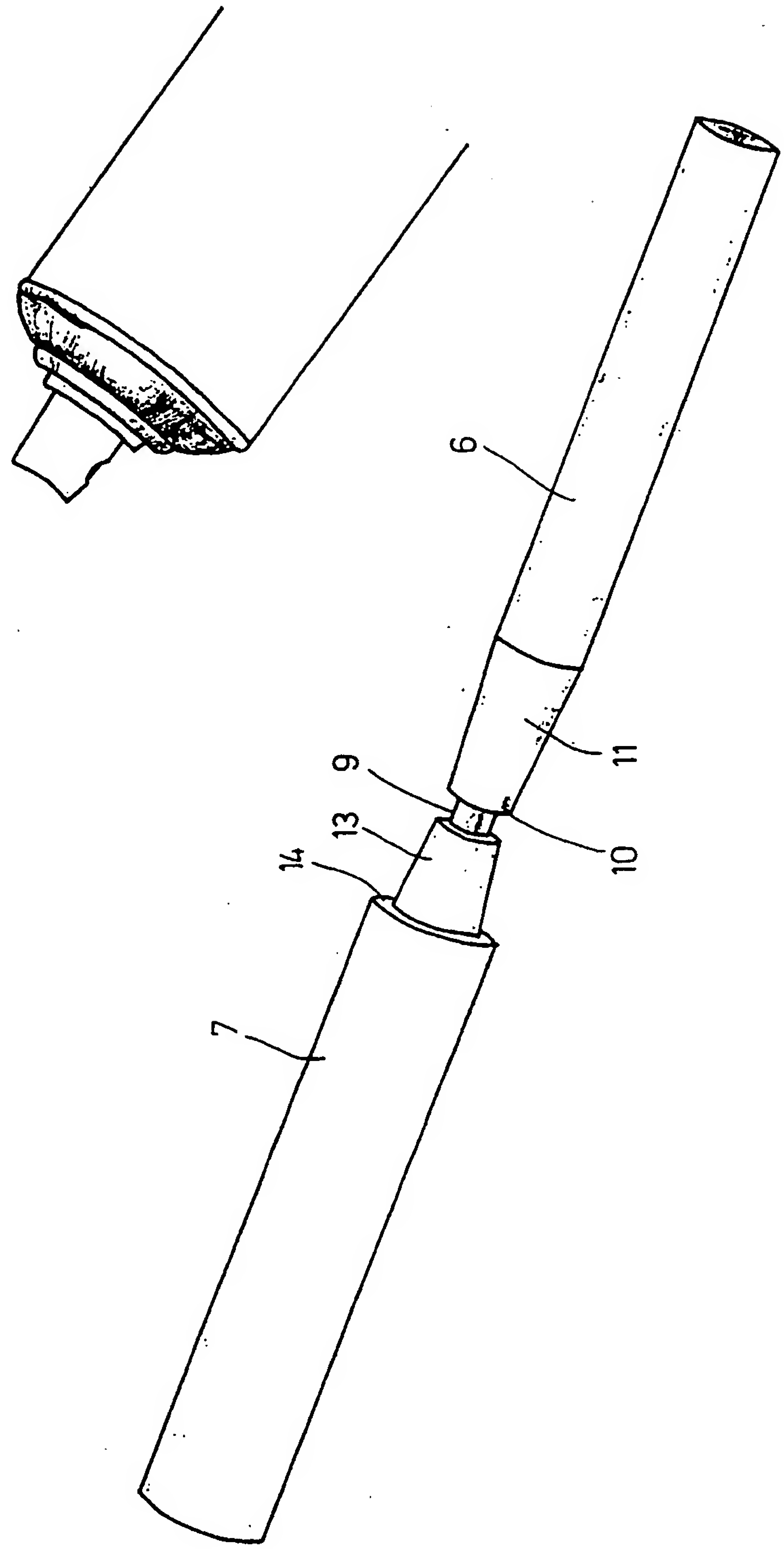

FIG. 7

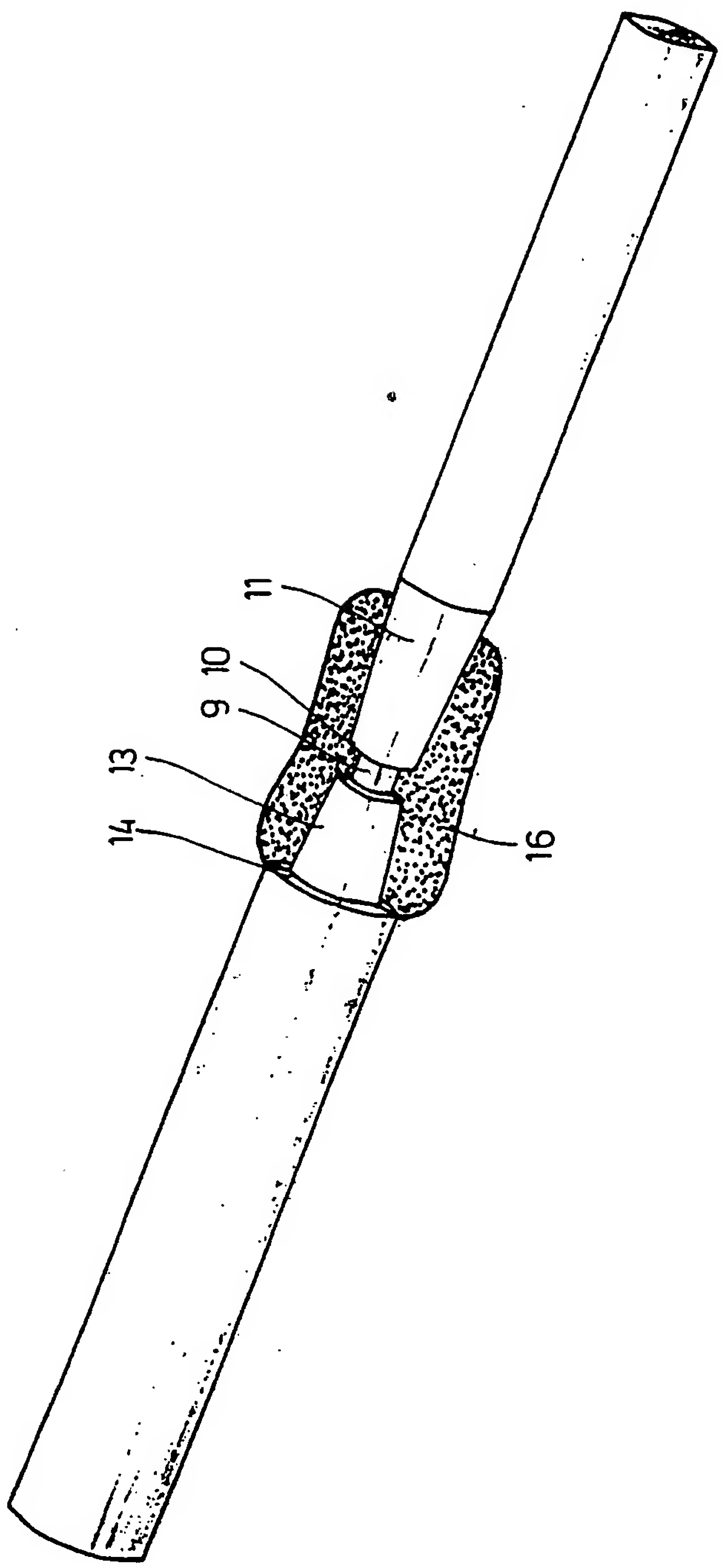

FIG. 8

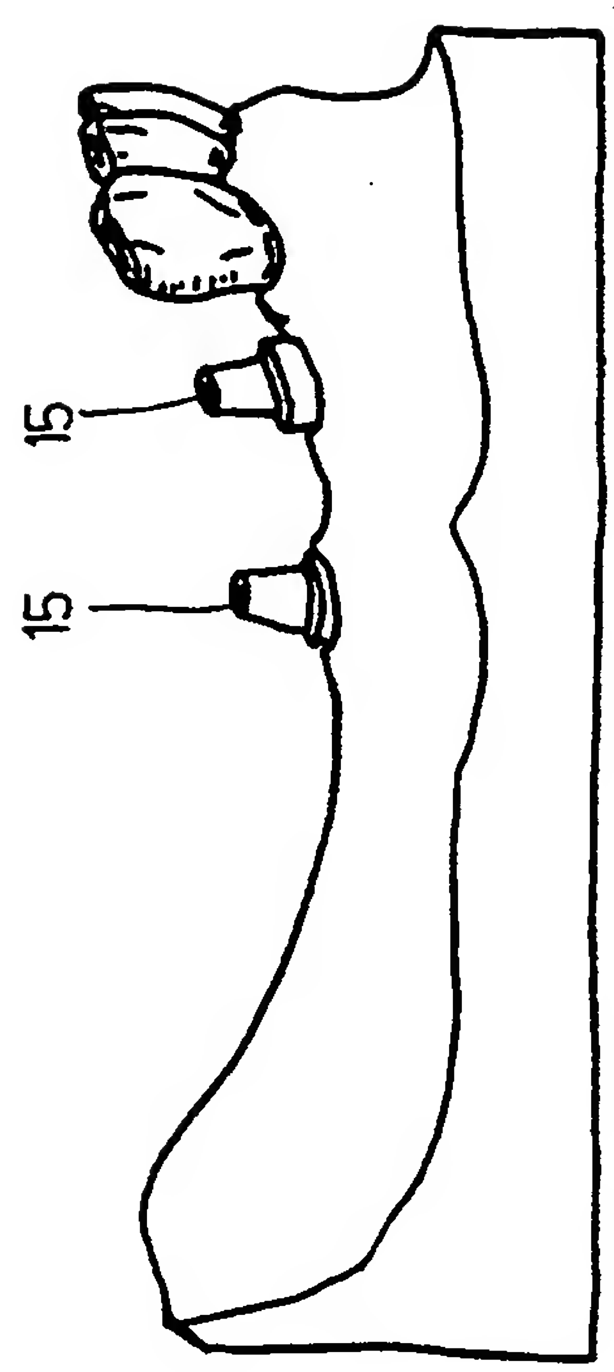

FIG. 9

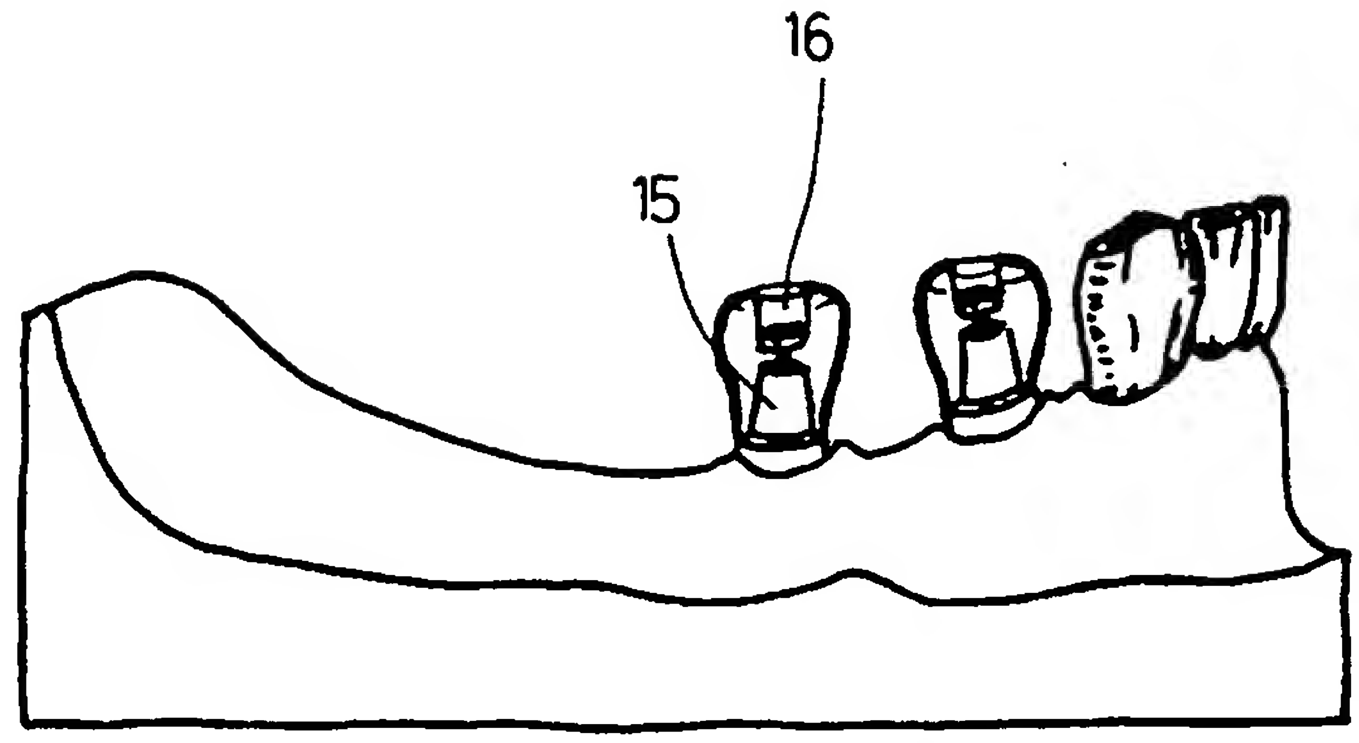

FIG. 10

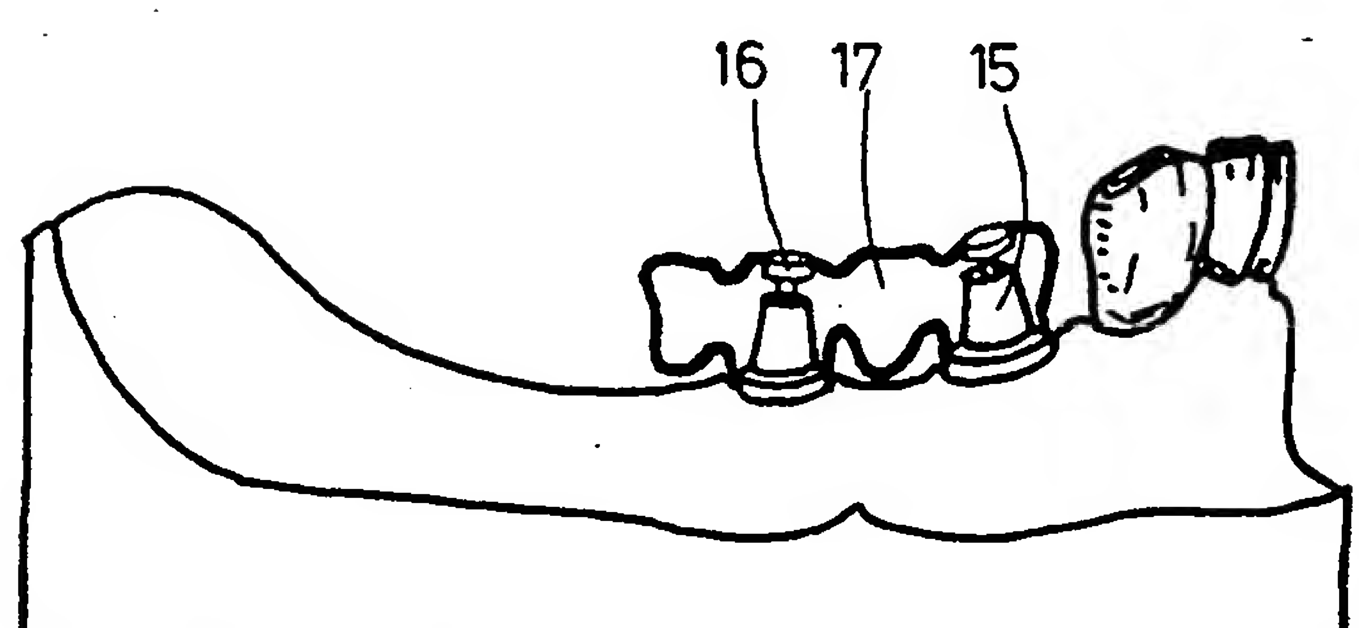

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 95/00197

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61C 5/10, A61C 13/00, A61K 6/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61C, A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0030850 A1 (COORS PORCELAIN COMPANY), 24 June 1981 (24.06.81) --	1-12
A	EP 0375647 A2 (SANDVIK AKTIEBOLAG), 27 June 1990 (27.06.90) --	1-12
A	EP 0389461 A1 (SANDVIK AKTIEBOLAG), 26 Sept 1990 (26.09.90) --	1-12
A	EP 0464951 A1 (ELEPHANT EDELMETAAL B.V.), 8 January 1992 (08.01.92) -- --------	1-12

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INTERNATIONAL SEARCH REPORT
Information on patent family members

28/08/95

International application No.
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